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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/580,890	05/25/2006	Sun Yang Kook	LPP20081318US	7135

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EXAMINER	
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ART UNIT	PAPER NUMBER
1727	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/580,890	YANG KOOK ET AL.	
	Examiner	Art Unit	
	Edu E. Enin-Okut	1727	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 June 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *16-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

<u>CATHODE ACTIVE MATERIAL FOR LITHIUM SECONDARY BATTERY, PROCESS FOR PREPARING THE SAME AND REACTOR FOR USE IN THE SAME PROCESS</u>

Detailed Action

1. The amendments filed on June 16, 2011 were received. Applicant has amended claims 16, 20 and 29. Claims 16-29 are pending.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

3. The rejection of claim 20 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, is maintained.

Regarding claim 20, the claim recites limitations with respect to the oxidation states of nickel, manganese and cobalt in the lithium metal composite oxide. However, as recited in its parent claim 1, these components may not be present in the lithium metal composite oxide. (*Examiner's Note:* Claim 1 recites compounds with a "Ni_x" component where "x has a value such that $0 \leq x \leq 1$". Thus, the compounds recited in claim 1 do not <u>require</u> nickel.)

Claim Rejections - 35 USC § 103

4. Claims 16, 17, 19, 20, 22, 26, 27, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohzuku et al. (US 2003/0170540) in view of Lambert, Jr. et al. (US 4,594,228). Additional supporting evidence provided by the Collins English Dictionary and the Chambers 21st Century Dictionary.

Regarding claims 16, 17, 19, 26 and 27, Ohzuku et al. teaches a process for preparing a positive electrode active material for a lithium secondary battery of a lithium-containing oxide having a general formula, such as $Li[Li_x(A_yB_{1-y})_{1-x}]O_2$ (where A and B are different transition metal elements (e.g., Fe, Ni, Mn and Co), $0 \leq x \leq 0.3$, and $0<y<1$) and $Li[Li_x(A_yB_yC_p)_{1-x}]O_2$ (where A and B are as described above, C is at least one kind of an added element different from A and B (e.g., Al, Mn, Ca, Sr, Yt, Yb, Fe, Ni, Mn and Co), $0 \leq x \leq 0.3$, and $0<2y+p<1$), and includes a oxides like a $LiCo_{1/2}Ni_{1/2}O_2$ and $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$ (Title; para. 24-26,40,41,55,56,138,211,212; Figs. 10,11; Claims 2,3,17,18). The lithium-containing oxide is obtained by mixing a precursor, a hydroxide or an oxide containing two or more kinds of transition metals, with a lithium compound, such as a lithium carbonate or a lithium hydroxide, and sintering the mixture (para. 35,37). The precursor is obtained, via coprecipitation, from an aqueous solution of metal sulfates (e.g., nickel sulfate, manganese sulfate, and cobalt sulfate), NaOH and NH_3 in a reaction bath within an apparatus such as that shown in Figs. 1 and 4 (para. 85-88,96-103,138,211,212; Figs. 1,4). The positive electrode active material is composed of a mixture of crystalline particles of the lithium-containing oxide having a particle size of 0.1-2 μm and a secondary particle of the lithium-containing oxide having a particle size of 2-20 μm, more likely 10-20 μm (para. 31,97; Claim 9)

As to producing the first and second lithium composite oxides separately, the transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held not to patentably distinguish the process. *Ex parte Rubin*, 128 USPQ 440 (Bd. Pat. App. 1959). See MPEP 2144.04 (IV)(C).

As to the ranges in the formulas for the first and second lithium metal oxide recited in claims, it has been held that obviousness exists where the claimed ranges overlap or lie inside

ranges disclosed by the prior art. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP 2144.05 (I). Further, it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). See MPEP 2144.05 (II).

As to the first lithium composite oxide having a mean particle diameter less than 90% than that of the second lithium metal composite oxide, Ohzuku teaches that the positive active material is composed of a mixture of crystalline particles of the lithium-containing oxide having a particle size of 0.1-2 μm and a secondary particle of the lithium-containing oxide having a particle size of 2-20 μm, more likely 10-20 μm, as discussed above. It has been held that obviousness exists where the claimed ranges overlap or lie inside ranges disclosed by the prior art. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP 2144.05 (I). Further, it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). See MPEP 2144.05 (II).

Regarding claim 20, to the extent that the claim can be understood, Ohzuku teaches a positive electrode active material composed of a lithium-containing oxide can include compounds like a $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$, as discussed above. As to the oxidation value of nickel, manganese and cobalt, applicant states in paragraph 121 of the instant specification that the cathode active materials described on in Examples 1-11 have nickel, manganese and cobalt oxidation values as recited in the claim. Thus, these oxidation values are found to be an inherent characteristic of the composite cathode material comprising all the claimed elements.

Since the prior art does teaches a composite cathode material comprising substantially the same elements or components as that of the applicant, it is contended that the active material of the prior art has similar oxidation values. Products of identical chemical composition can not have mutually exclusive properties, and thus, the claimed property (i.e. the specific output energy density), is necessarily present in the prior art material. The courts have held that "[p]roducts of identical chemical composition can not have mutually exclusive properties." A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See MPEP 2112.

Regarding claim 22, Ohzuku et al. teaches the aqueous solution containing nickel sulfate, manganese sulfate and cobalt sulfate, which is three metal salts being used as the metal precursor (para. 211-212).

Regarding claim 29, Ohzuku teaches the method for preparing a composite cathode active material as discussed above with respect to claim 1. Two experimental apparatus, as shown in Figs. 1 and 4, are used to produce the precursor described above (para. 46,49,85-88,96-103; Figs. 1,4). Both apparatus have agitating rods with a number of rotary vanes affixed thereto (Figs. 1,4; see annotated figures below). Further, since a baffle is defined as a device (as a plate, wall, or screen) to deflect, check, or regulate flow or passage (as of a fluid, light or sound) (see baffle (noun) on Merriam-Webster Online Dictionary), both apparatus also include a number of baffles (Figs. 1,4; see the annotated figures below).

Annotated figures from Ohzuku:

FIG. 1

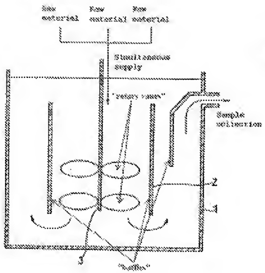
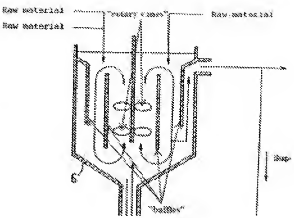


FIG. 4



Although Ohzuku does not expressly teach the rotary vanes being the reverse vane type; or, that the baffles have a shape of a flat panel and are connected to the inner wall via connecting rods, it has been held that, to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not to amount to the mere claiming of a use of a particular structure. *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976); *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). Further, a change in shape is generally recognized as being within the level of ordinary skill in the art. *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966)> See MPEP 2144.04 (IV).

However, Lambert teaches a mixing apparatus with an agitator shaft including an impeller with blades pitched downward, and an impeller with blades pitched upward, mounted thereon (Title; 3:63-4:27). These impellers produce a downward flow and an upward flow, respectively (5:39-41, 5:35-36). Thus, it would obvious to one of ordinary skill in the art at the time of the invention to pitch the vanes used the reactor employed in the method of Ohzuku to form one set of vanes producing flow in one direction, and another set producing flow in an

opposite direction, because Lambert teaches use of these type of vanes configured in this manner case disperse liquids that stagnate near both the top and bottom of the reactor (see Lambert, 5:57-60, 5:63-65); and, it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950). See MPEP 2144.04 (VI).

5. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohzuku et al. (US 2003/0170540) and Lambert, Jr. et al. (US 4,594,228) as applied to claims 16, 17, 19, 20, 22, 26, 27, and 29 above, and further in view of Watanabe et al. (JP 09-129230 A; refer to JPO Abstract and machine translation).

Ohzuku and Lambert are applied and incorporated herein for the reason above.

Regarding claim 18, Ohzuku does not expressly teach that the cathode active material includes about 5-40 wt % of the first lithium metal composite oxide.

Watanabe teaches a $LiN_xM_{1-x}O_2$ positive active material used in a nonaqueous electrolyte secondary battery (M is any one or more of Co, Mn, Cr, Fe, V, and Al; and, $1>x\geq0.5$) (Abstract; machine translation, para. 16,32). The positive active material is composed of mixture of particles with sizes of 0.1-2 μm and 2-20 μm where the 0.1-2 mm particles compose 5-50 wt % of the mixture (machine translation, claims 1, 2, para. 17).

It would have been obvious to one of ordinary skill in the art at the time of the invention to include from 5-40 wt % of the first lithium composite oxide in the cathode composite active material made using the method of Ohzuku, as modified by Lambert, because Watanabe teaches that controlling the size of the mixture of particles in a positive active material can assist in improving the capacity, cycle and charging characteristic of a battery using that material (see Watanabe, machine translation, para. 15,21); and, it has been held that obviousness exists

where the claimed ranges overlap or lie inside ranges disclosed by the prior art. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP 2144.05 (I).

6. Claims 21 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohzuku et al. (US 2003/0170540) and Lambert, Jr. et al. (US 4,594,228) as applied to claims 16, 17, 18, 19, 20, 22, 26, 27, and 29 above, and further in view of Aladjov (US 5,788,943).

Ohzuku and Lambert applied and incorporated herein for the reason above.

Regarding claim 21 and 28, Ohzuku does not expressly teach that the first and second mixtures are exposed to ultrasonic energy. However, Aladjov teaches a method for making an electrode material for a battery where controlling the application of ultrasonic energy to a reactor used to form the electrode particles facilitate the production of particles in a wide range of proportions (sizes) (Title; 5:32-51). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to expose the first and second mixtures used in the method of Ohzuku, as modified by Lambert, because Aladjov teaches that the application of ultrasonic energy can assist in controlling the size and crystal structure of the particles formed (see Aladjov, 5:32-51).

7. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohzuku et al. (US 2003/0170540) and Lambert, Jr. et al. (US 4,594,228) as applied to claims 16-22 and 26-29 above, and further in view of Tanigawa et al. (US 2002/0164527).

Ohzuku and Lambert applied and incorporated herein for the reason above.

Regarding claim 23, Ohzuku teaches the concentration for the aqueous ammonia solution is 4.8 mol/liter, the concentration of the aqueous nickel sulfate is 1.2 mol/liter, the

concentration of the aqueous manganese sulfate is 1.2 mol/liter, and the concentration of the aqueous cobalt sulfate is 1.2 mol/liter (para. 211).

Ohzuku does not expressly teach that the concentration of the aqueous ammonia solution is between 0.2 and 0.3 of the aqueous metal solution.

Tanigawa teaches a process for making a positive electrode active material with precipitation of a nickel hydroxide powder from an aqueous solution containing nickel ion and at least an ion of Co or Mn, and that it is possible to manipulate the composition, particle circularity, particle size, specific surface are and crystallinity of the obtained active material by managing and controlling the concentration, pH, and retention time of the aqueous solution in the reaction vessel (para. 58-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary concentration of the aqueous solution in the reaction vessel employed in the method of Ohzuku, as modified by Lambert, because Tanigawa teaches that by managing and controlling the concentration of the aqueous solution in the reaction vessel it is possible to manipulate the composition, particle circularity, particle size, specific surface are and crystallinity of the obtained active material (see Tanigawa, para. 58-61). Discovery of optimum value of result effective variable in known process is ordinarily within skill of art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

The remaining limitations recited in this claim have been addressed above with respect to claim 22.

Regarding claim 24, Ohzuku teaches 4.8 mol/liter of aqueous NaOH being added to the apparatus (para. 211).

Ohzuku does not expressly teach the aqueous NaOH being added to make a pH of 11.0 to 11.5.

However, Tanigawa also teaches a process for making a positive electrode active material with precipitation of a nickel hydroxide powder from an aqueous solution containing nickel ion and at least an ion of Co or Mn, and that it is possible to manipulate the composition, particle circularity, particle size, specific surface are and crystallinity of the obtained active material by managing and controlling the concentration, pH, and retention time of the aqueous solution in the reaction vessel (para. 58-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the pH of the aqueous solution in the reaction vessel employed in the method of Ohzuku, as modified by Lambert, because Tanigawa teaches that by managing and controlling the pH of the aqueous solution in the reaction vessel it is possible to manipulate the composition, particle circularity, particle size, specific surface are and crystallinity of the obtained active material (see Tanigawa, para. 58-61). Discovery of optimum value of result effective variable in known process is ordinarily within skill of art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

8. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohzuku et al. (US 2003/0170540) and Lambert, Jr. et al. (US 4,594,228) as applied to claims 16-24 and 26-29 above, and further in view of Sun et al. (US 6,071,489).

Ohzuku and Lambert are applied and incorporated herein for the reason above.

Regarding claim 25, Ohzuku teaches mixing and reacting a nickel manganese cobalt composite hydroxide with lithium hydroxide to obtain $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$ (para. 211,212).

Ohzuku does not expressly teach a chelating agent being used in the step of obtaining the lithium metal composite oxide. However, Sun teaches glycolic acid being used as a chelating agent in the step of preparing the lithium cathode active material, so that a pure phase

of lithium cathode active material powder is prepared (12:29-35). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize glycolic acid as a chelating agent in the step of forming the lithium positive electrode active material, which is the lithium metal composite oxide, employed in the method of Ohzuku, as modified by Lambert, because Sun et al. teaches glycolic acid being used as a chelating agent in the step of preparing the lithium cathode active material, so that a pure phase of lithium cathode active material powder is prepared (see Sun, 12:29-35).

Conclusion

9. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Hosoya et al. (WO 03/063275 A1; refer to US 2004/0076882 as an English equivalent) teaches a cathode active material composed of a mixture of a first lithium-transition metal composite oxide containing Ni and Co and a second lithium-transition metal composite oxide containing Ni and Mn (Abstract; para. 42-51).

Response to Arguments

10. Applicant's arguments filed June 16, 2011 have been fully considered but they are not persuasive. In sum, applicant argues the following in its remarks:

(a) Ohzuku does not teach a producing first and second lithium metal composite oxides separately, as recited in claims 1 and 29 (p. 8, 9,10);

(b) Ohzuku does not teach a first lithium metal composite oxide having a formula as recited in claim 27; and,

(c) Ohzuku does not teach the reactor having "an agitator having a first set of rotary vanes designed to induce fluid flow in a first direction and a second set of rotary vanes designed to induce fluid flow in a second direction that is reverse from the first direction" (p. 10-11; see also Declaration filed on May 25, 2006).

In response to applicant's arguments, please consider the responses below:

(a) and (b) Applicant is directed the rejection of the amended claims presented above.

(c) It is noted that the Declaration does not address the reactor presented in Fig. 1 of Ohzuku and discussed in the previous Office Action and the rejections above. Thus, it not sufficient to overcome those rejections using the Ohzuku reference. Further, applicant is also directed to the rejection of the claims above.

11. As to the remainder to applicant's arguments, they have been considered but applicant has amended the claims such that new grounds of rejection were necessitated.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Edu E. Enin-Okut** whose telephone number is **(571) 270-3075**. The examiner can normally be reached on Monday to Thursday, 7 a.m. - 3 p.m. (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara L. Gilliam can be reached on (571) 272-1330. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you

would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edu E. Enin-Okut/
Examiner, Art Unit 1727

/Barbara L. Gilliam/
Supervisory Patent Examiner, Art Unit 1727